AMDHS ADVANCES IN MEDICAL, DENTAL AND HEALTH SCIENCES

e-ISSN: 2581-8538

RESEARCH ARTICLE OPEN ACCESS

Medical Education Online: Worries and Hopes

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Received: 13-December-2022, Manuscript No. amdhs-22-83278; **Editor assigned:** 15-December-2022, PreQC No. amdhs-22-83278 (PQ); **Reviewed:** 16-December-2022, QC No. amdhs-22-83278 (Q); **Revised:** 17-December-2022, Manuscript No. amdhs-22-83278 (R); **Published:** 26-December-2022; DOI: 10.5530/amdhs.2022.4.13

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Published by : OZZIE PUBLISHERS

Abstract

This review is aimed at identifying and synthesizing existing literature relating to the worries and hopes for the development and implementation of online learning in medical education, between 2006 and 2022, reiterating the positive impacts of mobile apps in medical education. The review emphasizes: Evaluating existing literature relating to the impacts of mobile apps in medical education and identifying the worries and hopes that restrict and aid e-learning from medical educators, students, and stakeholders' perspectives, respectively. Reviews available did mention how mobile devices are bridging gaps, beating the preconceived notions that computer-based tools always take longer than expected. Despite that mentioned, this review further reiterates the positive aspects of mobile apps to E-learning as Accessible 24/7, saving time, and cost-effective. Students considered mobile technology to be useful for educational purposes, so by eliminating the barriers in this field, it is possible to promote mobile learning for medical and nursing students. Moreover, due to the ever-changing nature of e-learning and the skills needed for e-learning, staff, and students alike requires skills updates; otherwise, a downward trend is imminent. This review sub-questions are in tandem with the available articles' themes in terms and principle and go further as a gap filler by addressing the 'Geographical Inequalities' (as synonymous to internet access difficulties) as a major barrier to medical education online; Low and Middle-Income Countries (LMICs) in general tend to face greater health challenges, largely due to their decreased resources in comparison to Higher-Income Countries (HIC). Sub-Saharan Africa in comparison to the Middle East and North Africa (MENA) and Southeast Asia within the so-called LMICs, experiences the highest disease burdens, as a result of many factors among which health education is of considerable importance. Doing goodness to online healthcare learnings, in general, will expand the health workforce's capacity to deal with disease burdens across all geographical demarcations. **Results:** Findings suggest that the main worries affecting the development and implementation of medical education online include geographical inequalities, negative attitudes, and lack of technical know-how. Hopes for the identified barriers lie in policy adjustment, incentives, and skill(s) updates. **Conclusion:** Results can be used to inform policymakers, stakeholders, and educational institutions.

Keywords: E-learning, Online learning, Medical education, Vocational, Barriers, Worries, Solutions, Hopes, African College of Health, mobile apps, m Health, Geographical disparities, Geographical inequalities, LMICs

Introduction

COOver the last couple of decades, there has been a shift in medical education practice from traditional forms of teaching to other media which employ online, distance, or electronic learning [1]. As described by Howlett et al, "Electronic (e) or online learning can be defined as the use of electronic technology and media to deliver, support and enhance both learning and teaching and involves communication between learners and teachers are utilizing online content" [2].

Online learning can provide students with "easier and more effective access to a wider variety and greater quantity of information" [3]. However, the transition from traditional (long-established face-to-face lectures) to online learning is not without hurdles that drive students and educators alike, as well as driving departments to find alternatives that are more desirable for a learner-oriented self-paced learning experience. Technology-enhanced learning has become main-stream in undergraduate medical programs, and medical students worldwide rely on online modules, videos, and other electronic resources to complete their training [4].

Smart devices and the use of medical apps are prevalent among medical students. This will continue to rise in the future among both medical students and doctors [5]. Over the last decade, approaches to the delivery of educational content have changed dramatically, as medical education at all levels is now benefitting from the use of web-based content and applications for mobile devices [6]. Findings show that smartphones and related medical education apps are widely used by medical students and improve their educational experiences. Universities should develop a policy regarding smartphone usage for academic purposes [7].

In 2016, more than 7,000 health-related apps are available and used by healthcare professionals around the world [8]. According to a Tech firm (Mobius MD) 2021 statistic; there are over 350,000 m Health apps available in major app stores. It can be concluded that; Mobile applications are effective tools for enhancing knowledge and skills. They can be considered effective adjunct tools in medical education by considering their low expense, high versatility, reduced dependency on regional or site boundaries, online and offline, simulation, and flexible learning features of mobile apps [9]. Medical education has many long-established differing teaching methods, including face-to-face lectures. This particular approach to educational practices can manifest within a teaching culture, becoming pervasive within an organization or discipline, and leading to a reluctance to adopt new and emerging practices and technologies [10,11].

Medical graduates of the twenty-first century are expected to 'hit the ground running', requiring not only a traditional clinical education but also one that is up-to-date with the latest technologies to ensure flexibility in a dynamic workplace [12]. There has never been a greater need for educators, students, and clinicians to continuously update their skills, to remain abreast of the changing healthcare environment, and to remain 'digitally literate'. Digital literacy has been defined as:

1. The ability to use digital technology, communication tools or networks to locate, evaluate, use and create information

2. The ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers
3. Literacy includes the ability to read and interpret media, reproduce data and images through digital manipulation, and evaluate and apply new knowledge gained from digital environments [11,13].

The advent of mobile apps and social media technology outburst provides opportunities for students (easy access). Educational institutions are left with no option but to assume a crucial role in guiding and supporting the effective use of technology for smart learning.

Many factors can influence whether an online learning program will succeed or fail, ranging from student-led factors to staff-led factors [14,15]. For example, "cultural resistances" among staff have previously been identified as a barrier to student engagement with technology-based education; therefore, staff-focused initiatives may be a key to the introduction of successful e-learning programs [14]. It has also been recognized that changes and developments in medical education are putting extra pressure on already overworked faculty [16]. When considering the implementation of e-learning within a medical school or program robust evidence-based research may strengthen one's position when encouraging faculty to remain abreast of technological advances. It will aid in addressing underlying concerns among medical faculty who may be resistant to integrating e-learning into teaching practices.

To ensure a robust evidence base for, or against, e-learning in medical education, an account must be taken of all perspectives (student, educator, training body/school/university). Studies revealed that most of the past reviews were mostly focused on worries and hopes for students and medical educators' online perspective, in both synchronous and asynchronous aspects, with little attention paid to the good news; the advent of mobile apps. This review, therefore, aims to fill this gap in the literature.

Traditionally, there were never enough student-teacher interaction schedules that cover medical education curricula volume. Mobile apps might have in recent times offer an upward trend, now that interactions could be easily carried around in small handheld devices. Compared to the usual non-computer-based learning that requires both sides seated in studies. Reviews available did mention how mobile devices are bridging gaps, this study further reiterates the positive aspects of mobile apps to E-learning: Accessible 24/7, saves time and is cost-effective. Students considered mobile technology to be useful for educational purposes, so by eliminating the barriers in this field, it is possible to promote mobile learning for medical and nursing students [10].

Methods

A review was conducted over sixteen months (to supplement the previous studies conducted between 2006 and 2022), by the research lead at the African College of Health. The data collection solely included google forms statistical analysis extracted from 10 voluntary responses gathered across several borders. Data collation was carried out by the lead researcher (author). Data analyzed were compared and blended with the available review outcomes, incorporating the framework of Whittemore & Knafl [17].

The search included Science Direct, Scopus, Biomedical, PubMed and Google Scholar, and the All aboard Report. Search terms included online learning, medical education, mobile apps, development, worries, hopes, and digital literacy. The author solely searched. Titles and abstracts were screened and reviewed with inclusion/exclusion criteria. Articles were screened for inclusion. Data appraisal was performed (check listed) using the Critical Appraisal Skills Programme (CASP) Qualitative Research/ Referencing (Harvard style citation). Data extraction was completed using the Cochrane Data Extraction Form (Qualitative).

▪ Search strategies

A search/collation strategy was devised over 16 months (May 2021 to September 2022) with input from the research lead (author). The databases were: Science Direct, Scopus, Bio-medical, PubMed, Google Scholar, and Google forms app responses. Search terms included online learning, medical education, mobile apps, development, worries, hopes, and digital literacy. The author solely searched. Titles and abstracts were screened and reviewed with inclusion/exclusion criteria.

Grey literature sources searched included ProQuest Dissertations & Theses (UK & Ireland), ProQuest Dissertations & Theses (A&I), University of Limerick Institutional Repository, and University College Dublin Institutional Repository and a reference list was also searched for relevant studies. Boolean operators (AND, OR) were used, and search terms included "online learning", "distance learning", "medical education", "mobile apps" and "digital literacy".

▪ Inclusion and exclusion criteria

All peer-reviewed journal articles that reported empirical research, were published in English over 16 years from 2006 to 2022 and focused on the positive impacts of mobile apps in medical education. Experience in online/e-learning was included. Medical educators were defined as those teaching vocational health trainees, medical students, or postgraduate trainees. Studies that specifically outlined interventions relating to improving digital literacy skills among medical educators/students were included. Qualitative, quantitative, and mixed-method studies were also included.

Studies that evaluated e-learning/online learning beyond medical education were excluded. Studies that were not written in the English language were excluded.

▪ Data appraisal

Data appraisal was performed (check listed) using the Critical Appraisal Skills Program (CASP) Qualitative Research/Referencing (Harvard style citation). Data extraction was completed using the Cochrane Data Extraction Form (Qualitative).

▪ Data extraction

Qualitative data was extracted using Supplementary Guidance Notes for Inclusion of Qualitative Research in Cochrane Systematic Reviews of Interventions [18]. Quantitative and mixed method data were extracted using an extraction tool, which included aspects of Noyes et al. [18,11]

▪ Data analysis

Thematic analysis was employed in this review, by mixed methods (qualitative and quantitative).

▪ Search results

The initial review, conducted in 2018, used mixed method parameters to filter 3101 abstracts across all sources to 10, for inclusion as stated [11]. 8 out of 10 included articles were analyzed qualitatively, and a mixed method was employed for the rest 2 articles. Data were extracted using guidelines [19] which included the aims of each study, sampling approach, participant characteristics, data collection methods, and data analysis approach [11].

▪ Identified worries and hopes at the sight

In the paper, highlighted five sub-themes, this review of sub-questions are in tandem with the five themes in terms and principle and go further as gap filler by addressing the Geographical Inequalities as a major barrier to medical education online [11] **(FIGURE 1)**.

Skill deficit

Lack of skills, in particular technical skills, was found to be one of the barriers met by educators when engaging in the development and implementation of online learning [20]. Insufficient computer and typing skills together with poor infrastructure can inhibit educators' willingness

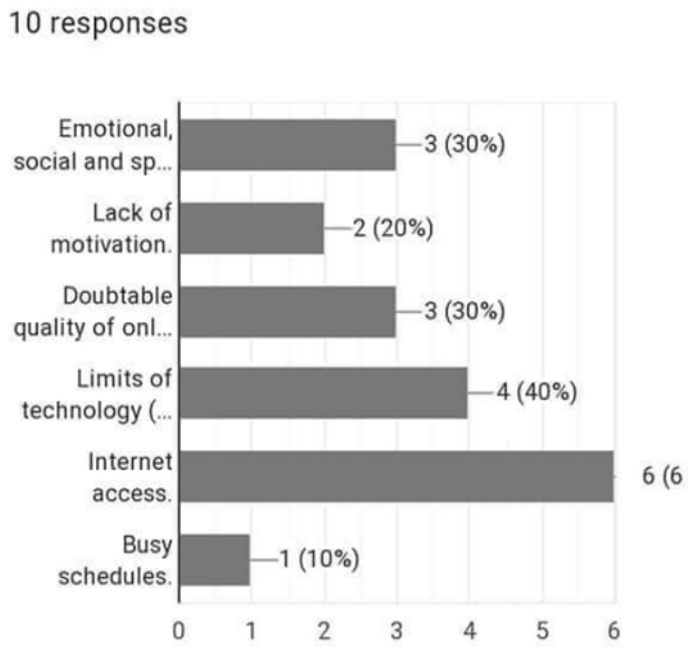

FIGURE 1. The main barrier to medical education online in sub-Saharan Africa is internet accessibility (6 out of 10)

or ability to engage with the development or delivery of online learning [21].

Solution-Engagement: To gain the necessary skills, it was acknowledged that engaging with e-learning, including the development of such programs, was important for gaining skills for teaching practice [20].

"I participated so that I could learn a bit more about teaching in an electronic environment. I think I learned quite a bit" [20]. Perlman et al. argue the importance of providing faculty with the necessary skills via training provided on the use of the e-Portfolio tool [22]. Workshops allowed faculty to learn this new skill and gain familiarity with the tool through use and from instructional design staff who were present during workshops. To ensure the success of the program, faculty needed to receive the necessary training on the tool.

Time

Medical educators are already pressured to find sufficient time to manage teaching, research, and maintain a work-life balance with personal life commitments [23]. In this context, inadequate time to devote to the mastery, development, and implementation of online learning tools can be seen as a significant barrier. This expectation of time to be invested can be seen as detrimental in an educator's pedagogical system with preconceived notions that computer-based tools "always take longer than expected" [20]. Interestingly, lack of time appears to be linked with a lack of incentives to engage with online or e-learning [24]. Perlman et al. highlight time as a barrier for faculty engaging in using an electronic e-Portfolio tool [22]. Faculty members had to invest uncompensated teaching time, as they were not afforded protected administrative time due to the pilot nature of the program. It was noted that to ensure the effective use of such a teaching instrument, educators must be afforded the time to become familiar with and engage with this type of tool. Faculty spent on average four to five half days of clinical work in preparing and using the tool.

Solution-Time: The adoption of digital tools can free up time allowing medical educators to learn concepts and to reflect on practices [21]. Furthermore, where educators are asked to spend time engaging with the development or implementation of online learning, it is proposed that there should be a formal mechanism for faculty reward and acknowledgment for efforts [24].

Infrastructure

In many instances, the lack of infrastructure and technology can be seen as a barrier to medical education, typically in low-medium-income countries [15]. Many of these countries lack technological basics, such as email, while others comment on the poor quality of services, such as intermittent internet access or photocopying. These technological limitations can act as a barrier to e-learning within a faculty and geographical context [15]. For example, Attardi & Rogers identified technical issues such as poor internet connectivity as barriers to the live broadcasting of lectures in their institution in Canada [25]. Bediang et al. highlight how poor internet connectivity, Wi-Fi, and access to physical infrastructure are issues that are faced in a low-income country such as Cameroon [15]. Lakbala's study also highlights the different barriers met by health profession educators in implementing e-learning in a low-income country such as Iran. Barriers identified include limited access to computers and poor physical infrastructure [26].

Solution-Cost: Maloney et al. found that where a break-even analysis is completed to determine the true cost of web-based education, the web-based approach was 'robustly superior to a traditional face-to-face education, allowing the lower number of enrollments for a program to reach its break-even point' [27]. While this analysis might not always be an approach adopted by medical schools in developing an online program, it is suggested as one of how one might look at the cost of establishing the correct infrastructure not as a barrier but as a potential solution to a barrier.

Poor communication

Where there was a lack of institutional support and limited direction as to how tools or programs would be implemented, implementation was rarely successful [28]. "It was felt that in the early stages of the faculty of health, many projects were begun, but the structure was missing within the faculty to see them through" [28]. Implementing e-learning is often reported as a process that is adopted in polarization; while the adoption of e-learning tools may be taking place across several departments in an institution, there may be a lack of interdepartmental communication which is seen as a barrier. "We can't work alone! We need to work as a team" [28]. The asynchronous environment generated is perceived as one which does not support the active exchange of ideas and shared knowledge. "I have found it difficult at times to have a 'discussion' online, as you are never quite sure about the exact meaning of what people are saying" [21].

Solution-Collaboration: Bediang et al. found that one of the most important ways in which implementation of online/e-learning programs can be completed successfully is to include all relevant stakeholders and departments within a faculty and for new approaches to be adopted to facilitate collaboration [15]. They specifically outlined the need for e-learning managers to put appropriate mechanisms in place to (i) have qualified and dedicated human resources, (ii) allocate financial resources, and (iii) support all stakeholders according to their needs. Perlman et al. noted that the provision of institutional support to faculty so that they might continue to participate in the development of online programs and for their future success is imperative [22]. An institutional strategy is therefore required which facilitates the implementation of key skills and the adoption of methodologies by faculty when implementing online learning [15].

Attitude

The negative attitude among educators in engaging with new technologies and tools can be seen as a barrier to the development and implementation of online learning. Educators noted feeling overwhelmed with the entire process of engaging with new tools and having little patience for navigating minor technical issues [29,30]. "If you ask me to peer-review something that I have no expertise in, I'm reluctant to do that" [20]. Such feelings of inadequacy, stemming from limited knowledge of, or proper training with, a particular tool may be influencing the attitude of some educators

when asked to commit to implementing and developing online learning practices. Promoting the use of the m Health app by medical students for educative purposes could facilitate their future implementation in healthcare settings [30].

Solution-Culture: Maintaining a positive attitude in the face of seemingly difficult-to-use and time-consuming e-learning tools and technologies can be quite problematic. Educators involved in one study noted that it was important to try to maintain a positive attitude. "Try to maintain a positive attitude and assume that any slights or overly harsh criticism are due to the asynchronous communication and to not take it personally". Adopting these new tools may produce a positive experience overall and even break down preconceived notions; "I guess the interesting thing is that I'm old, and you can teach an old dog new tricks" [21]. Fostering a change of norms and attitudes, therefore, is an indispensable solution in the development and implementation of online learning in medical education. This review sub-questions are aligned with the five themes & Solutions discussed above in terms and principle and go further as gap filler by augmenting **(FIGURE 1)**.

Geographical disparities

Historical analyses of geographical inequalities in educational participation shed light on the complexity and heterogeneity of society [31]. Transitions to remote learning have heightened awareness of broadband inequities. Access to reliable broadband varied significantly across geography ($P<0.01$). Compared with their urban peers, rural youth face more challenges in accessing the technology and connectivity needed for remote learning and telehealth inequities [32]. This review sub-questions are in tandem with the available articles' themes in terms and principle and go further as a gap filler by addressing the 'Geographical Inequalities' (as synonymous to internet access difficulties) as a major barrier to medical education online. Low and Middle-Income Countries (LMICs) in general tend to face greater health challenges, largely due to their decreased resources in comparison to Higher-Income Countries (HIC). At the same time, Limits of technology within Sub-Saharan Africa are not counterbalanced in comparison with its LMICs counterparts in the Middle East and North Africa (MENA), and Southeast Asia. An independent web-based study conducted within the Sub-Saharan Africa shows that 6 out of 10 Africans do not subscribe to online learning as a result of internet access difficulties **(FIGURE 1).**

Solution-Policy adjustment: Inadequate broadband infrastructure is a critical barrier to the provision of telehealth services and remote learning in rural areas, as well as LMICs, efforts to improve policies and advance technology must consider geographical disparities to ensure health and education equity [32].

Result

Findings suggest that the main worries affecting the development and implementation of medical education online include geographical inequalities, negative attitudes, and lack of technical know-how. Hopes for the identified barriers lie in policy adjustment, incentives, and skill(s) updates.

Discussion

Key worriers and hopes concerning medical education online are thematically synthesized in this review, with emphasis on geographical disparities/inequalities, from the medical educator and student's perspectives. These included locations, skills, resources, institutional strategies, and support and attitude with similar themes across many studies.

The study was basically from the educator's perspective, though mobile apps' advent has shifted attention to the student's realm, the previous review highlights the ubiquity of barriers to online learning across diverse medical education systems and speaks to a shared history of attempting to overcome them [33].

While positive experiences were identified, with some educators commenting on the fact that they enjoyed engaging with new tools, there was a firm emphasis on the need for strong institutional support behind such developments. Where there was a lack of institutional support and limited direction as to how such tools or programs would be implemented, implementation was rarely successful [34]. A clear institutional strategy, therefore, is recommended when implementing online learning [35]. There is also a strong need for inter-faculty collaboration to ensure that a cohesive education is available for learners [36-39].

Conclusion

Geographical inequalities, negative attitudes, and lack of technical know-how are some of the known obstacles facing medical education online. Hopes for the identified barriers lie in policy adjustment, incentives, and skill(s) updates. Mobile apps save time, are accessible 24/7, and are cost-effective. Students and teachers considered mobile technology to be useful for educational purposes, development of mobile apps for medical education is highly imperative.

Limitations of the review

There are limitations within this study that need to be acknowledged,

Despite rigorous search methodologies, some studies may have been missed by the nature of the search strings used, if the keywords did not appear in the title or abstract [1].

Recommendations for further research

Specific themes highlighted in this review such as geographical inequalities within the LMICS and poor technical skills require further exploratory approaches.

Acknowledgments

Many thanks to Volunteers across the world for filling out the web questionnaire at the African College of Health

Funding

Self-Funding covers the design of the study, collection, analysis, and interpretation of data.

Contributions

Volunteers were responsible for the acquisition of data. Google Forms App analyzed & interpreted the data obtained internally. The author drafted and revised the manuscript.

Availability of data and materials

All relevant data are included in the article.

Ethics approval and consent to participate

Not Applicable.

Conf ict of Interest

None

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Cite this article as: Olawale RA. Medical Education Online: Worries and Hopes. Adv. Med. Dental Health Sci. 2022;5(4):59-63